50. On some Land-Planarians collected in Western Australia and Tasmania by Members of the British Association for the Advancement of Science. By Arthur Dendy, D.Sc., F.R.S., F.Z.S., Professor of Zoology in the University of London (King's College).

[Received November 3, 1915 : Read November 23, 1915.]

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During the visit of the British Association to Australia in 1914, exceptional facilities were afforded to those members who visited Western Australia and Tasmania for the collection of zoological material for future investigation. In Western Australia various zoological expeditions were most successfully organized by Professor W. J. Dakin, and in Tasmania similar excursions were admirably arranged and carried out by Professor Flynn. Some of these expeditions were devoted to the collection of marine animals, while on others the members who took part in them had ample opportunities for the investigation of the terrestrial invertebrates.

During my residence in Australia, many years ago, I had already paid particular attention to a section of the terrestrial fauna which I [1895 *bis*] termed "Cryptozoic," comprising those small animals, for the most part invertebrates, which habitually hide away beneath logs and stones, or under the bark of trees. This faunistic assemblage includes many lizards, frogs and toads, centipedes and millipedes, scorpions, spiders, Peripatus, insects of many kinds—especially cockroaches—many slugs and snails, a large number of land-planarians, and, more rarely, land-nemertines.

Of the Land-Planarians, the species of which are more or less readily distinguished by their beautiful colour-markings, I have on previous occasions described many different kinds from Australia, Tasmania and New Zealand, while many others have been described by Messrs. Fletcher and Hamilton, Professor Baldwin Spencer and Mr. Thomas Steel. It was naturally, therefore, a great pleasure to have the opportunity of returning once more to my old pursuits and collecting again species that were long ago more or less familiar to me. In addition to these, however, several hitherto undescribed forms were met with, so that altogether we obtained three species in Western Australia and six in Tasmania.

From Western Australia only four species have hitherto been described, all by Mr. Steel [1901], and all three obtained by us appear to be new.

From Tasmania, Steel [1901 *bis*] gives a list of twelve species, six of which were originally described by myself. Of these twelve, the British Association party obtained three, together with one previously known only from Australia and two new ones.

By far the commonest species in Tasmania seems to be *Geoplana tasmaniana*, originally collected on the historic voyage of the 'Beagle' and described by Charles Darwin.

It is curious that so few Australian zoologists have concerned themselves with the study of the Land-Planarians. This is the more to be regretted inasmuch as the opportunities for collecting these animals are rapidly passing away with the clearing of the bush. Moreover, much remains to be done in the investigation of these and other Cryptozoic animals. The Land-Planarians, in particular, still demand thorough comparative anatomical investigation with a view to revising the generic classification. Thus von Graff [1899] has proposed the genus Artioposthia, based on material supplied by myself, to include certain forms with a remarkably complex copulatory apparatus, but until many more species have been anatomically investigated it is difficult to estimate the value of this suggestion and impossible to say in many cases to which genus a given species should be referred. For this reason I retain the generic name Geoplana in its older and wider sense.

I desire to express my great indebtedness, not only to our generous Australian and Tasmanian hosts, but also to those members of the British Association who were good enough to hand over to me the Land-Planarians which they collected.

A. *Species collected in Western Australia.*

GEOPLANA DAKINI sp. n.

When crawling, very long and narrow, as much as three or four inches in length; strongly convex dorsally, flattened ventrally; without longitudinal ridges. A well-grown specimen in spirit measures about 74 mm. in length by 3 mm. in width in the middle, and is approximately oval in transverse section. The eyes are arranged as usual. The peripharyngeal aperture is situated about the middle of the body; the pharynx when protruded in spirit is subcylindrical. I have been unable to make out the genital aperture.

In life the dorsal surface is pale yellow, mottled and striped with olive-brown; the ventral surface is white, without pattern, and the anterior tip is pink.

The colour-markings on the dorsal surface are typically arranged as follows:—There is a narrow median stripe of brown and on each side of it a band of clear yellow ground-colour of about twice the width. This is followed by a band of brown, less sharply defined than the median stripe and of about twice the width. We may call this the inner paired stripe; it is followed by a somewhat wider band of ground-colour mottled with minute brown specks, and then comes an outer paired stripe similar to the inner one. In life there is a fairly wide band of clear ground-colour visible on the dorsal surface outside each outer paired stripe, but in spirit this tends to be turned in by contraction, so that the outer paired stripe comes to lie at the margin of the dorsal surface. The degree of distinctness of the paired stripes varies considerably, and they sometimes tend to merge into the mottling that lies between them.

There are thus five narrow longitudinal dark stripes on the dorsal surface, and in this respect the species resembles the common *G. quinquelineata* of Eastern Australia, to which it is probably closely related. It differs from that species, however, in that the dark stripes are not placed at equal distances apart, and in this respect it agrees with *G. mediolineata* Dendy, var. *simularis* Steel [1901], from South and Western Australia. It differs from both these species, however, in the presence of the mottling between the inner and outer lateral stripes.

This species was common in the neighbourhood of the Mundaring Weir, near Perth, W.A., upwards of a dozen specimens having been collected by our party. I have much pleasure in naming it after my friend Professor W. J. Dakin, D.Sc., who did so much to bring about the striking success of our zoological expeditions in Western Australia.

GEOPLANA FLAVILINEATA sp. n.

When crawling, the dorsal surface is convex, the ventral flat: there are no longitudinal ridges. In spirit the ventro-lateral margins are rather prominent and the ventral surface may be concave. The larger of the two specimens in spirit measures 40 mm. in length by 3·5 mm. in width in the middle. The eyes are numerous, but it is difficult to make out their arrangement in spirit specimens. The peripharyngeal aperture is situated somewhat in front of the middle of the ventral surface, the genital a little nearer to the peripharyngeal than to the posterior extremity of the body.

In life the dorsal surface is dark olive-grey, or purplish, with five very narrow longitudinal stripes of pale yellow, not at all conspicuous. The ventral surface is yellowish white, without markings; and the horseshoe-shaped anterior tip is pink.

The colour-markings on the dorsal surface are seen, under a lens, to be arranged as follows in the most strongly marked specimen:—The very narrow median yellow stripe is edged on either side by a very narrow dark grey band; this is followed by a very narrow yellow stripe (the inner paired stripe), narrower and less distinct than the median stripe. Then comes a much broader band of finely mottled grey, bounded on the outside by another very narrow yellow stripe (the outer paired stripe). The outer paired stripe is much more distinct than the inner one and is accentuated by the presence of a very narrow, almost black edging to the broad band of dark grey, finely mottled ground-colour which lies outside it and extends to the ventro-lateral margin of the body.

The characteristic feature of the pattern seems to be the presence of five very narrow, pale yellow stripes on a dark background of finely mottled grey, the interval between the median stripe and the inner paired stripe being considerably less than that between the two paired stripes. In the specimen described above the inner paired stripe is almost obsolete, while the outer one is quite clearly defined; in the other specimen both paired stripes are equally strongly developed, but neither of them is nearly so distinct as the median stripe, and the outer one has only a feebly developed dark edging on the outside.

This species seems to be closely related to Steel's *Geoplana fusco-dorsalis* [1901], also found near Perth.

I have only two specimens, both of which were obtained in the neighbourhood of the Mundaring Weir.

GEOPLANA COMITATIS sp. n.

Body in life comparatively short and broad. Dorsal surface in life pale dusky yellow, with olive-brown stripe and mottling; ventral surface white or grey, without markings; anterior tip pink.

The arrangement of the pattern on the dorsal surface is as follows:—There is a narrow median dark stripe. The interval between this and the margin of the body is divided into three bands of about equal width, viz., an inner band of clear ground-colour, an outer band of clear ground-colour, and an ill-defined intermediate zone in which the ground-colour is thickly sprinkled with minute dark specks.

The eyes are arranged as usual. The peripharyngeal aperture is situated about the middle of the body and the genital aperture somewhat nearer to it than to the posterior end. There is, however, a good deal of variation in this respect, depending upon the state of contraction.

The body in spirit is rather short and thick, averaging about 25 mm. in length by 4 mm. in width in the middle; it is approximately oval in transverse section, with no trace of marginal ridges.

This species bears a strong resemblance to *Geoplana tasmaniana* Darwin, but may be distinguished by the following features. Although there is one pair of ill-defined, broad dorsal bands of brown mottling, very much as in *G. tasmaniana*, there never appears to be a marginal (or submarginal) mottling or stripe. The general colour of the dorsal surface in spirit specimens is much yellower than in *G. tasmaniana.* The body (in spirit) is thicker, less flattened dorsally, and much more rounded at the margins. Steel [1901 *bis*] has described a supposed variety of *Geoplana tasmaniana* which he calls *flavicincta*, which seems to come a good deal nearer to *G. comitatis* than the typical form. It seems to me hardly likely, however, that the West Australian species is really identical with the Tasmanian "variety."

I have eleven specimens of this species, all collected in the neighbourhood of Mundaring Weir. The specific name *comitatis* is given in allusion to the British Association.

B. *Species collected in Tasmania.*

GEOPLANA TASMANIANA (Darwin)*.

Planaria tasmaniana Darwin [1844].
Geoplana tasmaniana Fletcher & Hamilton [1887].
Geoplana tasmaniana Dendy [1893].
Geoplana balfouri von Graff [1899].
Geoplana tasmaniana Steel [1901 *bis*].

This certainly seems to be by far the commonest of the Tasmanian Land-Planarians, and it has been obtained from many widely separated localities. In September 1914 Dr. Nicholls collected a number of specimens on Maria Island, and it was also much the commonest species in the neighbourhood of the Great Lake, which some of us subsequently visited.

The following notes were made on living specimens from Maria Island:—"Eyes as usual. When crawling long and "narrow, but dorsal surface somewhat flattened as well as "ventral. Dorsal surface very pale yellow with very narrow "median stripe of dark grey or brown and two wider stripes of "the same colour but less intense. Ground-colour between "median and wide stripes minutely flecked with brown, also "fine marginal mottling of brown separated from wide dorsal "stripe by band of clear yellowish ground-colour. Colour of "stripes varies from olive-brown to reddish."

The marginal band of mottling may develop into a more or less distinct stripe and in spirit it becomes submarginal, visible from the ventral but not from the dorsal surface, so that there appear to be only three stripes on the dorsal surface (one narrow and two broad) and a narrow yellow margin.

Specimens when crawling measure about 45 by 3 mm. The largest specimens in spirit measure about 34 by 3·5 mm.

The shape of the body in transverse section, in spirit-specimens, is somewhat flattened both above and below and with slightly pronounced marginal ridges.

A colour variety, represented by two specimens from the neighbourhood of the Great Lake, is characterized by the intensification of the dorsal stripes, the darkening of the ground-colour between the median and paired stripes, and the disappearance of the marginal mottling. The following notes were made on these specimens during life:—"Dorsal surface dark brown, nearly "black, with narrow median black line and a broader supra-"marginal black band, separated from the median stripe [line] "by an intervening zone of dark brown. All these dark parts "appear at first sight as one very broad dark brown band, with a "narrow white margin on either side." In spirit the margins of the body are very pale brown, not white like the ventral surface.

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* [The parentheses around the names of authors placed after scientific names in this paper are used in accordance with Article 23 of the International Rules of Nomenclature (Proc. 7th Int. Cong. Boston, 1907, p. 44 (1912)).—EDITOR.]

In another slight variety the intensification of the finely mottled ground-colour of the dorsal surface to form a pair of broad dorsal stripes does not occur.

Mr. Steel [1901 *bis*] has already pointed out that Professor von Graff [1899] was probably mistaken in refusing to accept my identification of this species with Darwin's *Planaria tasmaniana* and in proposing for it the new name *Geoplana balfouri*.

GEOPLANA QUINQUELINEATA Fletcher & Hamilton.

Geoplana quinquelineata Fletcher & Hamilton [1887].
Geoplana quinquelineata Dendy [1890, 1891, 1895, 1896].
Geoplana quinquelineata von Graff [1899].
Geoplana quinquelineata Steel [1901].

More than a dozen specimens were obtained from the neighbourhood of the Great Lake which seem to belong to this common and widely distributed Australian species. I at first considered them as representing a variety of *Geoplana tasmaniana*, in which the broad, inner, paired stripe on each side was broken up into two and the outer (marginal or submarginal) stripe obsolete, giving, together with the median line, five narrow longitudinal stripes, all on the true dorsal surface. The fact, however, that the animal (in spirit) is a good deal narrower, and at the same time less flattened, than *G. tasmaniana* has induced me to abandon this interpretation.

The specimens do not strike me as being quite typical examples of *G. quinquelineata*, for the inner paired stripe is about twice the width of either the median stripe or the outer paired stripe, but it is well known that *G. quinquelineata* is subject to a good deal of variation as regards the width of the stripes.

My notes on the living worm are very brief, as follows:—"Dorsal surface yellowish, with dark grey or brown stripes. "Ventral surface pale grey, without markings. Anterior tip "brown. Microscopic bluish or whitish specks appear under lens "on dorsal surface (? always). Eyes as usual."

In spirit the ground-colour of the continuous dorsal and lateral surfaces is light brown, and the lateral surfaces appear on either side of the narrow, white, creeping sole as a fairly broad band of this colour. All the dark stripes are visible from the dorsal surface only, the outer paired stripe being supramarginal. The body in section is oval, but somewhat flattened below. The largest specimen now measures 35 mm. in length by barely 3 mm. in greatest breadth.

This species has not previously been recorded from Tasmania.

GEOPLANA NICHOLLSI sp. n.

? *Geoplana diemenensis*, pars, Dendy [1894].
? *Artioposthia diemenensis*, pars, von Graff [1899].
? *Geoplana diemenensis* Steel [1901 *bis*].

This species was obtained on Maria Island by Dr. G. E. Nicholls and again at the Great Lake. The Maria Island specimens may be regarded as the types of the species. The Great Lake specimens differ but slightly.

The Maria Island specimens, in life, were considerably flattened even when crawling, but slightly convex above. Body tapering gradually in front to narrow, horseshoe-shaped tip. Posterior end bluntly pointed. Eyes as usual. Dorsal surface pale grey, finely mottled with dark brown, and with fine median dark brown stripe. Ventral surface pale grey, nearly white, without markings. Anterior tip light brown on both surfaces, or pinkish. A specimen, when crawling, measured 50 mm. in length by 4·5 mm. in greatest breadth (not far from the posterior end). When put in spirit the lateral margins turn in and become visible from the ventral surface as two narrow, mottled bands, one on either side of the broad creeping sole, forming two narrow lateral surfaces sloping downwards and inwards from the much flattened dorsal surface, which they join at an acute angle. In spirit the peripharyngeal aperture is situated not far from the middle of the body and the genital aperture rather nearer to it than to the posterior end.

In the spirit-specimens the mottlings have a distinct purple tinge and show a slight tendency to arrange themselves in six longitudinal bands on the true dorsal surface, three on each side of the narrow median dark stripe, the outer band on each side being close to the dorso-lateral margin. The largest spirit-specimen measures 32 mm. in length by 4 mm. in greatest breadth.

One of the Maria Island specimens was specially noted during life as being very dark brown dorsally. Narrow median stripe and mottlings still visible. In addition also microscopic specks of bluish white thickly dusted over dorsal surface.

The following notes were made on living specimens collected in the neighbourhood of the Great Lake :—" When at rest very " broad and much flattened on both surfaces. When crawling " long and narrow, with horseshoe-shaped anterior tip and pointed " posterior extremity. Eyes as usual. Dorsal surface pale grey " with narrow longitudinal stripe of dark grey-brown down the " middle, and thickly marbled with olive-brown, the markings

" showing a slight tendency to longitudinal arrangement. Ventral " surface pale grey without markings, nearly white. Anterior tip " pinkish brown. Colour of dorsal markings reddish brown, " almost chestnut, in some specimens." In these specimens the tendency of the markings on the dorsal surface to arrange themselves in three longitudinal bands on each side of the narrow, mid-dorsal, dark stripe, is more marked than in the Maria Island specimens. These specimens also do not attain so large a size as those from Maria Island, measuring in spirit about 25 by 4 mm.

This species is evidently closely related to the Australian *G. quadrangulata*, especially to the mottled Mount Wellington (Victoria) variety of that species. It is, however, a very much more robust form *, being intermediate in this respect between *G. quadrangulata* and the Tasmanian *G. diemenensis*.

The relationship between these three species requires careful investigation. *G. diemenensis*, it may be remembered, is characterized by the presence of remarkable comb-like copulatory organs, and is accordingly included by von Graff [1899] in his genus Artioposthia. Such organs have not been observed in *G. quadrangulata* or in *G. nichollsi* †, but we must not overlook the possibility that all the specimens of these species hitherto found have been immature and that the peculiar copulatory organs may be developed only in full-grown individuals. The specimens of *G. diemenensis* in which I observed these organs were collected in February ‡ and March, while those of *G. nichollsi* described above were collected in September. The size of the specimens may also depend largely on the time of year. Unfortunately, we do not yet know nearly enough about the life-history of land-planarians to enable us to settle these points.

Steel has already expressed a doubt as to whether all the specimens originally referred by me to *G. diemenensis*, and accepted as such by von Graff, really belong to the same species. He himself gives a figure of a specimen of " *G. diemenensis*," one of a small series of examples from Trevallyn Hills and Table Cape, but I am doubtful whether it really belongs to that species—or yet to *G. nichollsi*, which it seems to resemble fairly closely in pattern—because the transverse section appears to be of quite different shape, not at all quadrangular. Possibly, however, the outline given represents the transverse section in life, which is very different from what it is in spirit-specimens.

In the type-specimens of *G. diemenensis* from Mount Wellington (Tasmania) there was no narrow median longitudinal stripe on the dorsal surface, and I am inclined to think that the presence of such a stripe in *G. nichollsi* may serve as a valid specific distinction.

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* I have, however [1895], described a robust variety of *G. quadrangulata* from the Blue Mountains, N.S.W.

† See, however, footnote below.

‡ This was one of the Parattah specimens, and as it shows a narrow, mid-dorsal, dark stripe, I strongly suspect that it may be a specimen of *G. nichollsi*.

G. nichollsi may approach pretty closely to the common *G. tasmaniana* in general appearance, but may be distinguished by the sharper dorso-lateral margins, the sides of the body being rounded off (in spirit) in *G. tasmaniana*.

GEOPLANA MORTONI Dendy.

Geoplana mortoni Dendy [1894].
Geoplana mortoni von Graff [1899].
Geoplana mortoni Steel [1901 *bis*].

We obtained a dozen good specimens of this beautiful and well-characterized species in September 1914, in the neighbourhood of the Great Lake. It had been previously obtained by the late Mr. Alexander Morton from an unknown locality in Tasmania, and by Professor Baldwin Spencer from Parattah, and my own acquaintance with it was limited to spirit-specimens.

The following observations were made on a living specimen:—
"At rest very broad and much flattened, no median dorsal ridge. "Dorsal surface dull yellow, closely and finely mottled with chest-"nut-brown. Horseshoe-shaped anterior tip brown. Eyes as "usual. Ventral surface white, much less closely mottled with "small brown specks, with very narrow marginal band free from "mottling. When crawling, dorsal surface very strongly arched."

A good-sized specimen when crawling measured about 50 mm. in length by 4·5 mm. in greatest breadth, and one of my specimens measures as much after preservation in spirit.

The shape of the body in spirit-specimens is characteristic; convex above and concave below, especially in the anterior portion; broader behind than in front; with prominent, narrow margins at the junction of dorsal and ventral surfaces.

GEOPLANA TYPHLOPS Dendy.

Geoplana alba Dendy [1892].
Geoplana typhlops Dendy [1894].
Geoplana typhlops von Graff [1899].

This curious eyeless species appears to be one of the commonest of the Tasmanian land-planarians. It has previously been recorded from Mount Wellington, Hobart and Parattah, and in September 1914 we obtained it near the Great Lake and on Maria Island (one small specimen). Some of the specimens in spirit develop a distinct narrow median ventral band, due to darkening of the rest of the ventral surface. I have already noticed this feature in my previous descriptions.

GEOPLANA FLYNNI sp. n.

I propose this species for four specimens collected by Dr. Nicholls on Maria Island, and have much pleasure in naming it after Professor Flynn of Hobart, who so successfully organized the zoological excursions for members of the British Association in Tasmania.

The worm when crawling is long and narrow, convex above and flat below. The ground-colour of the dorsal surface in life ranges from grey to yellow, but even in the grey specimens it becomes fairly bright yellow in spirit. Minute brown specks are sparsely scattered over the dorsal surface and tend to arrange themselves in a very narrow median stripe. The horseshoe-shaped anterior tip is brown or brownish pink, and the ventral surface nearly white, without markings. The eyes are arranged as usual. In spirit the body is narrow, more or less flattened, especially ventrally, and with fairly well pronounced lateral margins.

In one specimen (in spirit) the peripharyngeal aperture is ated well in front of the middle of the body, and the genital aperture rather nearer to it than to the posterior end. This is the only one in which both apertures are visible, but in another the peripharyngeal aperture seems to be about central; but of course the position of the apertures is influenced by the relative state of contraction of the two ends of the body.

One of the four specimens is much larger than the other three, measuring in spirit about 32 mm. in length by a shade over 3 mm. in greatest breadth. The smaller ones in spirit measure about 19 mm. in length by 2·5 mm. in breadth. In life one of them measured about 32 by 2 mm.

I think that the specimen which I described [1892] under the name *Geoplana* sp., from near Hobart, probably belongs to this species. Von Graff [1899] referred this specimen to the Victorian *G. quadrangulata* var. *wellingtoni*, but there was very little justification for so doing, or, I fear, for my own comparison of it with *G. quadrangulata* and *G. ventropunctata*.

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